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ENVIRONMENTAL IMPACT RESEARCH PROGRAM SPRING- AND
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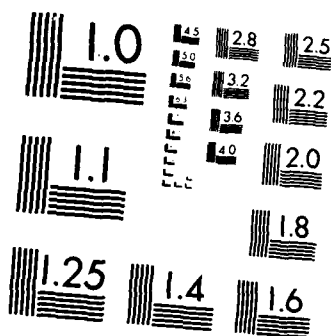
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ENVIRONMENTAL IMPACT
RESEARCH PROGRAM

TECHNICAL REPORT EL-86-45

SPRING- AND SPIKE-TOOTH HARROWS

Section 8.2.6, US ARMY CORPS OF ENGINEERS
WILDLIFE RESOURCES MANAGEMENT MANUAL

by

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FIELD	GROUP	SUB-GROUP										
19 ABSTRACT (Continue on reverse if necessary and identify by block number) <p>An equipment report on spring- and spike-tooth harrows is provided as Section 8.2.6 of the US Army Corps of Engineers Wildlife Resources Management Manual. The report is designed to assist the Corps District or project biologist with the selection and use of types of equipment and materials available for habitat development and manipulation. Topics covered include description, operation and maintenance, limitations, and availability.</p> <p>Spring- and spike-tooth harrows are secondary tillage implements designed to smooth seedbeds, incorporate soil amendments, cover broadcast seed, and break up soil clods. Management objectives for using the equipment are stated, and potential uses for developing wildlife habitat are discussed. The design and assembly of equipment are described and illustrated, and general specifications are provided. Methods of operation are described, and maintenance and safety requirements are given. Appropriate cautions and limitations are discussed.</p>												
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PREFACE

This work was sponsored by the Office, Chief of Engineers (OCE), US Army, as part of the Environmental Impact Research Program (EIRP), Work Unit 31631, entitled Management of Corps Lands for Wildlife Resource Improvement. The Technical Monitors for the study were Dr. John Bushman and Mr. Earl Eiker, OCE, and Mr. Dave Mathis, Water Resources Support Center.

This report was prepared by Mr. Ted B. Doerr, Range Science Department, Colorado State University, Fort Collins, Colo., and Dr. Wilma A. Mitchell, Wetlands and Terrestrial Habitat Group (WTHG), Environmental Laboratory (EL), US Army Engineer Waterways Experiment Station (WES). Mr. Doerr was employed by WES under an Intergovernmental Personnel Act contract with Colorado State University during the period this report was prepared. Mr. Chester O. Martin, Team Leader, Wildlife Resources Team, WTHG, EL, was principal investigator for the work unit. Personnel from Miss-Lou Equipment Company, Vicksburg, Miss., provided information on spring- and spike-tooth harrows and access to equipment. Mr. Michael Brooks, Florida Game and Freshwater Fish Commission, Tallahassee, Fla., and Mr. Myron Fuerst, Fuerst Brothers, Inc., Rhinebeck, N. Y., provided information on flexible tyne harrows. Review and comments were provided by Mr. Martin, WES, and Mr. Larry E. Marcy, Texas A&M University.

The report was prepared under the general supervision of Dr. Hanley K. Smith, Chief, WTHG, EL; Dr. Conrad J. Kirby, Chief, Environmental Resources Division, EL; and Dr. John Harrison, Chief, EL. Dr. Roger T. Saucier, WES, was Program Manager, EIRP. The report was edited by Ms. Jessica S. Ruff of the WES Information Products Division (IPD). Drawings were prepared by Mr. John R. Harris and Mr. David R. (Randy) Kleinman, Scientific Illustrations Section, IPD, under the supervision of Mr. Aubrey W. Stephens, Jr.

COL Allen F. Grum, USA, was the previous Director of WES. COL Dwayne G. Lee, CE, is the present Commander and Director. Dr. Robert W. Whalin is Technical Director.

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NOTE TO READER

This report is designated as Section 8.2.6 in Chapter 8 -- EQUIPMENT, Part 8.2 -- SITE AND SEEDBED PREPARATION EQUIPMENT, of the US ARMY CORPS OF ENGINEERS WILDLIFE RESOURCES MANAGEMENT MANUAL. Each section of the manual is published as a separate Technical Report but is designed for use as a unit of the manual. For best retrieval, this report should be filed according to section number within Chapter 8.

SPRING- AND SPIKE-TOOTH HARROWS

Section 8.2.6, US ARMY CORPS OF ENGINEERS
WILDLIFE RESOURCES MANAGEMENT MANUAL

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Spring- and spike-tooth harrows are secondary tillage implements designed to smooth seedbeds after plowing, incorporate soil amendments, cover broadcast seed, and break up soil clods. Spring-tooth harrows effectively control herbaceous annual vegetation, while spike-tooth harrows can be used without significantly disturbing existing vegetation. Greater soil penetration can be achieved with spring-tooth harrows than with spike-tooth harrows. Both types of harrows are widely used throughout the United States in a variety of agricultural operations. Harrows also have application as final seedbed preparation implements for wildlife food plots and specialized grazing pastures where the soils are deep and not rocky or debris laden.

The flexible tyne harrow is a versatile harrow that can be easily adapted to wildlife management practices. Primary uses include preparing seedbeds for food plots, cultivating row-planted wildlife foods, and smoothing surfaces of access roads and track census transects. It may also be used in planting and maintaining pasture-type forages for geese or large grazing mammals.

DESCRIPTION

Spring-tooth Harrow

Spring-tooth harrows are similar in appearance to chisel plows but are of lighter construction (Fig. 1). The cutting shanks are bolted or clamped directly to a rigid frame and coiled above the portion that tills the soil for increased flexibility (Fig. 2). The flexibility of the shanks (or tynes) allows independent movement over small rocks. Tynes are designed for maximum

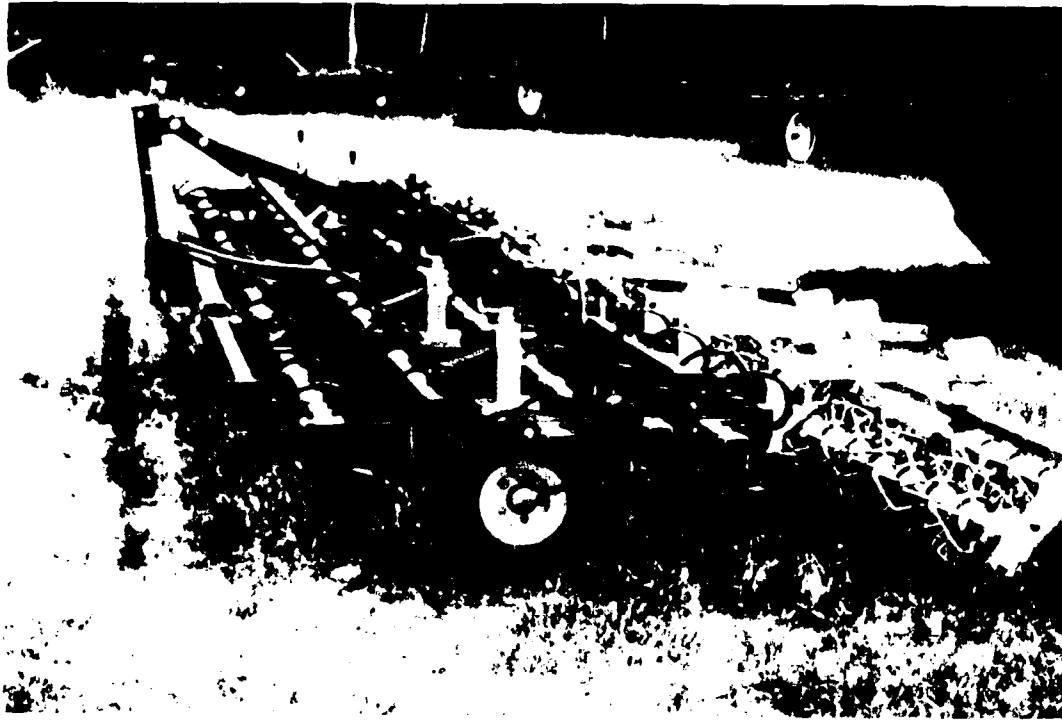


Figure 1. Example of a spring-tooth harrow

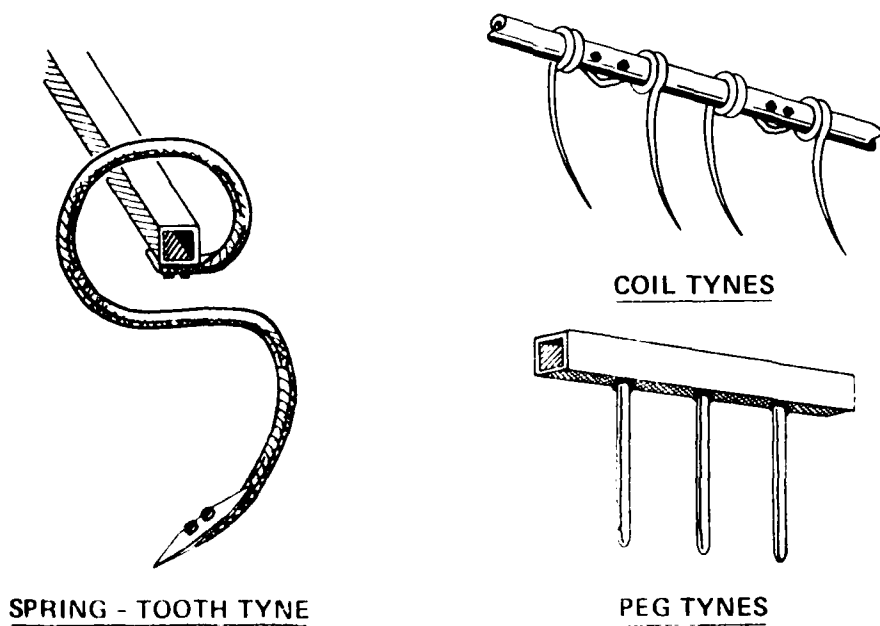


Figure 2. Detail of spring- and spike-tooth harrow tynes

flexibility and create vibrations as the harrow is operated, providing maximum soil smoothing and clod breakup. Cutting tips can be replaced on some spring-tooth harrows without replacing the entire tyne. The rigid frame is usually supported by wheels to provide accurate harrowing depth and transporting ease. Harrowing depth is usually controlled by a mechanical lever mechanism or by a hydraulic lift on larger harrows. Large spring-tooth harrows have folding sections for transport.

Spike-tooth Harrows

Spike-tooth harrows have solid tynes or coil tynes bolted to a rigid frame (Larson 1980) (Figs. 3 and 4). Solid tynes are basically peg-shaped and can be made from metal dowels, short angle irons, or other durable materials. The tynes are arranged in several rows and slanted to the rear to prevent clogging by debris. Details of spike-tooth harrow tynes are shown in Figure 2. Larger spike-tooth harrows are supported by wheels and have folding sections for transporting. Table 1 provides general specifications for spring- and spike-tooth harrows.

Flexible Tyne Harrow

The flexible tyne harrow is constructed of chain-link wire hooked onto a spreader bar that can be attached to a tractor, disk, or pickup truck (Fig. 5). Steel teeth, located at the angles of adjoining links, can be adjusted to project forward or backward for different depths of soil penetration (Fig. 6). Harrows are available in a variety of sizes; 4- to 6-ft-wide models weigh 115 to 150 lb, whereas 24-ft models weigh 800 to 900 lb. To accommodate the workload, sections can be added to or removed from most models. Because of its flexibility, this tyne harrow can follow the exact

Table 1. General specifications for spring- and spike-tooth harrows

<u>Feature</u>	<u>Spring-tooth harrows</u>	<u>Spike-tooth harrows</u>
Width	5-60 ft	6-75 ft.
Tyne spacing	6-12 in.	2-6 in.
Depth of penetration	1-6 in.	1-6 in.
Power requirements	20-315 hp	20-315 hp
Optional attachments	Various tyne tips	Coil tynes

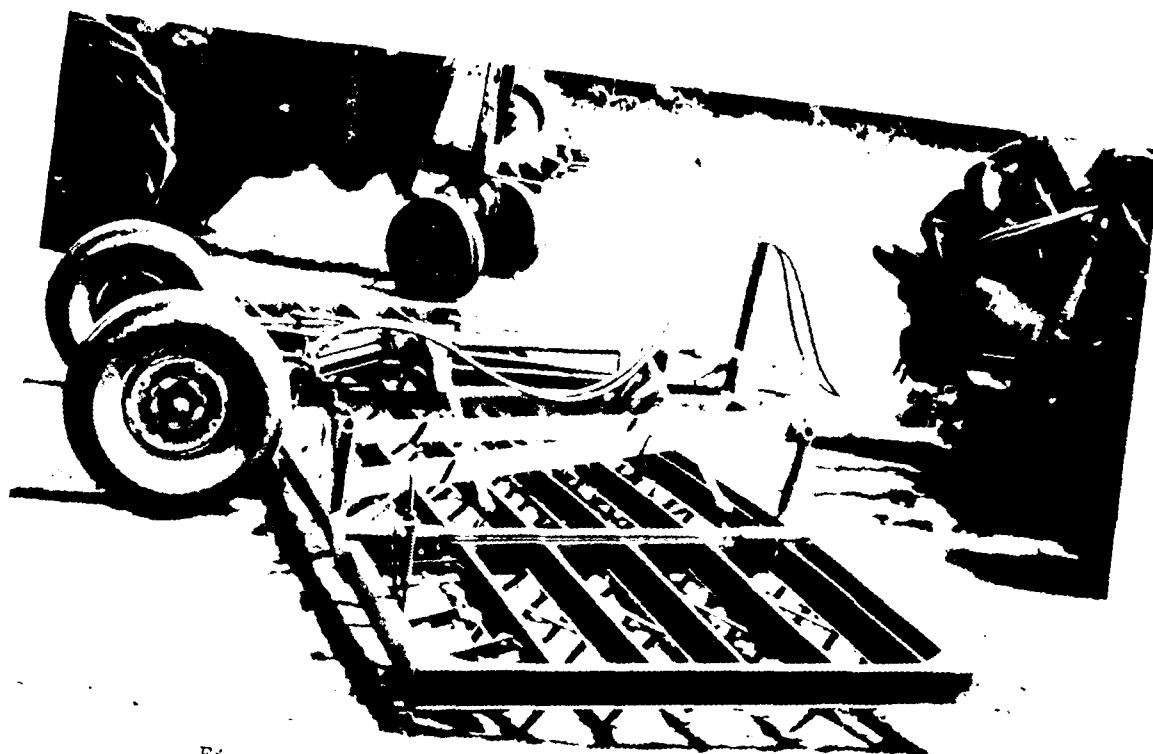


Figure 3. Example of a spike-tooth harrow

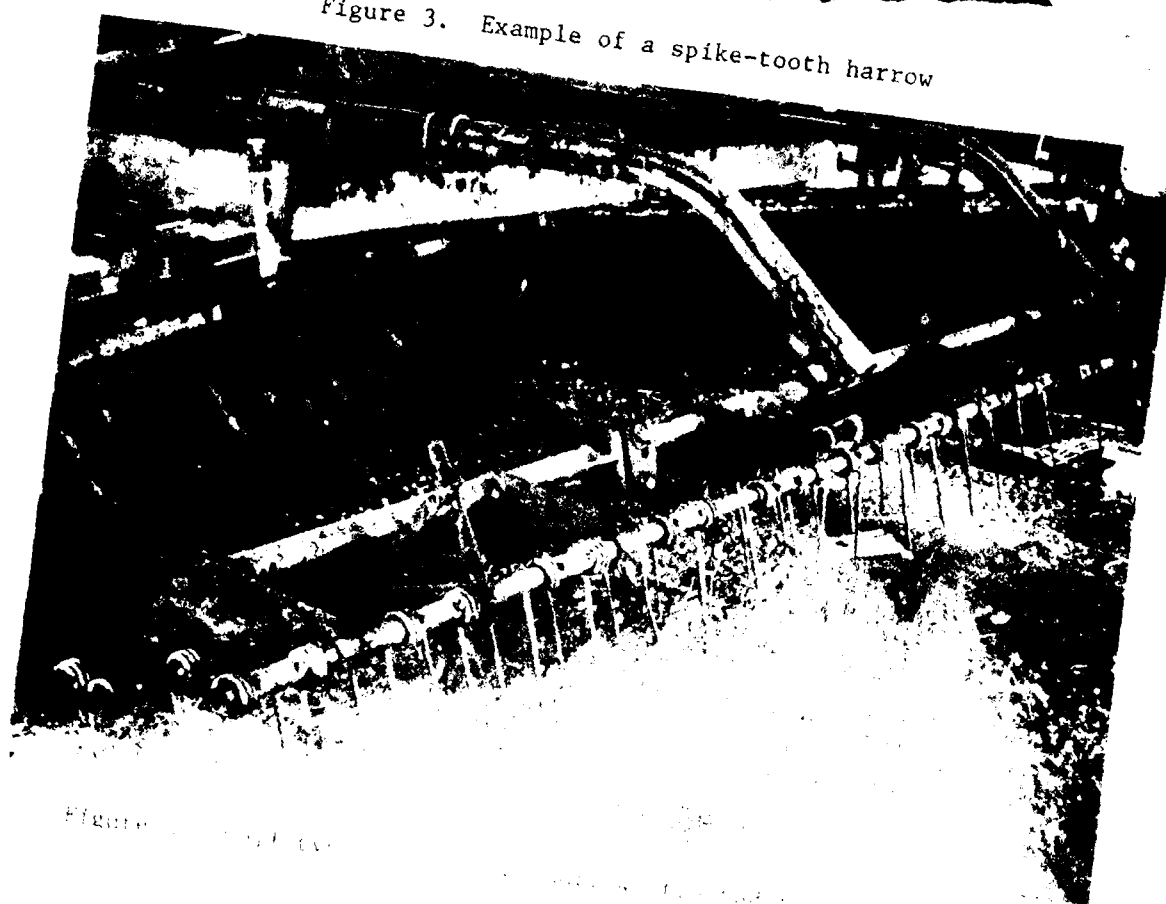


Figure 4. Example of a harrow

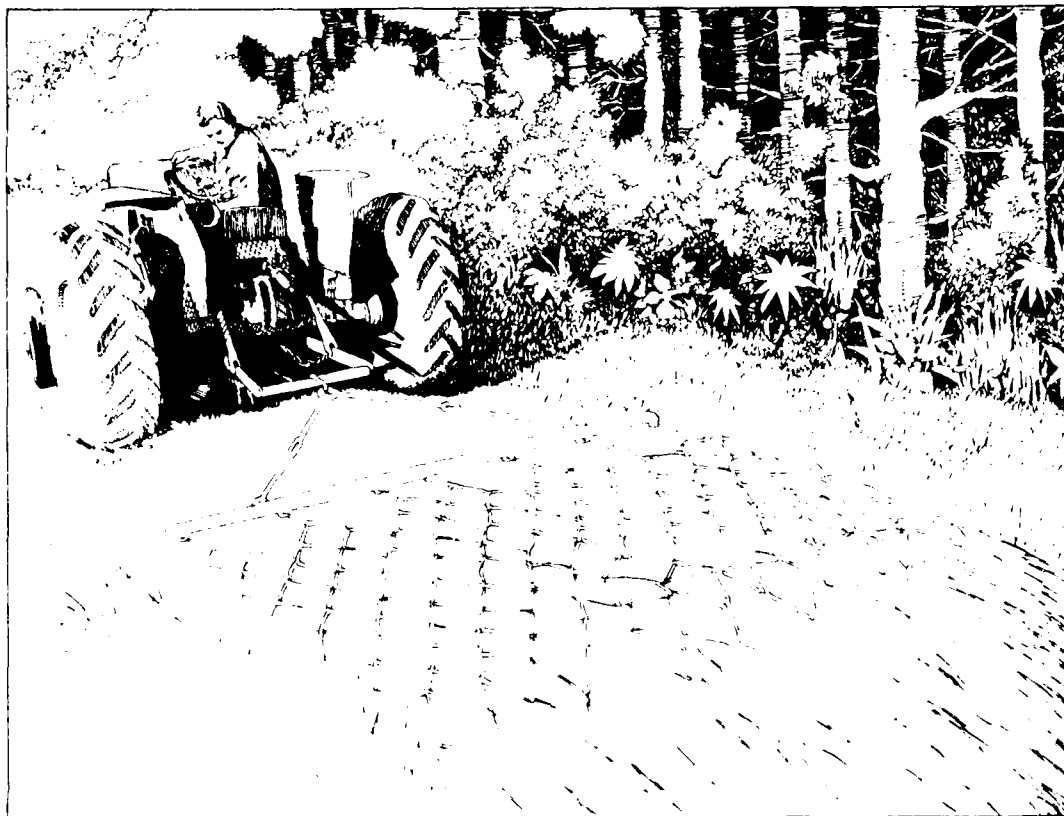
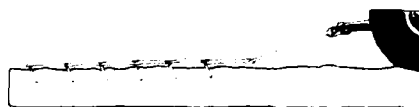
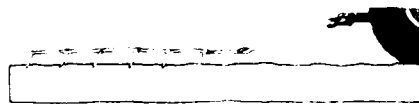


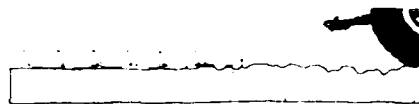
Figure 5. A flexible tyne harrow being used to prepare a food plot



a. MAXIMUM PENETRATION



b. LIGHT PENETRATION



c. SMOOTHING THE SURFACE

Figure 6. Position of teeth when the flexible tyne harrow is used for soil penetration (a, b) and for smoothing surfaces (c)

land contour. It is convenient to transport, as the 6-ft-wide models can be rolled up to a diameter of 18 in. and carried in the back of a pickup truck.

OPERATION AND MAINTENANCE

Spring- and spike-tooth harrows are towed behind a tractor at 10 mph. The flexible tynes shallowly penetrate the soil surface and vibrate. This dual action effectively shatters soil clods and crusted soil surfaces and smooths the seedbed, thus producing a homogeneous seedbed for drill seeding. Adding fertilizer, lime, or other soil amendments and mixing (incorporating) amendments into the soil using a harrow can be done in one step by mounting the amendment applicator on the tractor and attaching the harrow to the tractor. Wider cutting tips attached to spring-tooth harrows efficiently control undesirable herbaceous plants. Debris should be cleared from the harrow as it collects during operation. Tyne tips and bolts should be checked periodically and replaced when worn or broken.

Like other harrows, the flexible tyne harrow has several basic functions: (1) to break and level disked ground; (2) to cover seeds; (3) to uproot weeds; and (4) to remove debris. It is generally used for preparing seedbeds, cultivating crops, renovating pastures, and smoothing surfaces. For seedbed preparation this harrow can break loose soils or smooth surfaces after disking. It can break crusts on newly seeded grain cropland without disturbing young plants (36 in.) and is therefore good for the first cultivation of a crop. Pasture or hayland soils can be scarified for overseeding, and fertilizer can be worked into the soil with this implement. When inverted, it can serve as a drag mat to smooth surfaces of gravel and dirt roads, paths, and turfed areas.

LIMITATIONS

Excessive breakage of spring-tooth harrows precludes their use on extremely rough lands with large rocks and heavy debris. They should be used only for working the upper 6 in. on previously plowed areas. Spike-tooth harrows should not be used on rough or rocky land. They are useful only as a soil surface conditioner and are ineffective for increasing water infiltration unless it is caused by surface soil crusting.

The flexible tyne harrow should be used on loose moist soils such as sand, loam, or silt because it is not efficient in penetrating hard dry soils that contain large percentages of clay. On loose soils this harrow can be

used instead of heavier disks and harrows, thus making transportation and manipulation of equipment more convenient for management area sites.

AVAILABILITY

Spring- and spike-tooth harrows are available from most farm equipment manufacturers. The flexible tyne harrow is similar to other contour harrows that are commercially available. The harrow described in this report can be obtained from implement dealers or directly from the manufacturers at the following address:

Fuerst Brothers, Inc.
P. O. Box 271
Rhinebeck, NY 12572

LITERATURE CITED

Larson, J. E. 1980. Revegetation equipment catalogue. USDA For. Serv. Equipment Development Center, Catalogue No. 8042 2501. 198 pp.

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